DOCUMENT RESUME

ED 373 714 IR 016 724

AUTHOR Fulford, Catherine P.; Zhang, Shuqiang
TITLE "Tooling Up To Go the Distance" Video Interaction Analysis.
PUB DATE 94
NOTE 15p.; In: Proceedings of Selected Research and Development Presentations at the 1994 National Convention of the Association for Educational Communications and Technology Sponsored by the Research and Theory Division (16th, Nashville, TN, February 16-20, 1994); see IR 016 784.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Distance Education; Educational Technology; Elementary Education; *Evaluation Methods; Higher Education; *Inservice Teacher Education; Instructional Design; Interaction; *Interactive Television; *Interactive Video; Measures (Individuals); Reliability; Test Construction; *Videotape Recordings
IDENTIFIERS Hawaii

ABSTRACT

A new video evaluation instrument is demonstrated. It is designed specifically for distance education, to be used for instructional design consultation, distance education teacher training, or research. Categories include students interacting with teachers, with other students, and content. Analyzing interaction in two-way television requires an instrument suited to the setting. The university course used in instrument development provided teacher in-service training for a sequential kindergarten through grade 6 program that integrates science, health, and technology in Hawaii. The course was offered via interactive television to 233 teachers. Videorecordings and a written record of interaction events were used to evaluate one-way and two-way interactions and communication in the three defined categories. Four raters used the approach to evaluate the distance presentations. Overall reliability was high enough to warrant using the approach analyzing interaction in distance education, not just in terms of amount of time, but in terms of richness and patterns. Two tables and six figures present study findings. (Contains 20 references.) (SLD)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED 373 714

Title:

"Tooling Up to Go the Distance" Video interaction analysis

Authors:

Catherine P. Fulford
Shuqiang Zhang

University of Hawaii

2499 DOLE ST.
HONOLULU, HAWAII 96822

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

S.Zenor

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IR016724

Abstract

The purpose of this presentation is to demonstrate a new video evaluation instrument designed specifically for distance education. It was designed to be used for instructional design consultation, distance education teacher training, or research. Categories include students interacting with the teacher, other students, and content.

Instructional designers in distance education are not always developing instruction, they are facilitating the transfer of teachers from a traditional to a high tech setting. In a two-way television setting, teachers accustomed to the rich environment of subtle communication through body language may find themselves stymied by the cavernous feeling of a television classroom. Beyond the worries of the technology and "being on TV," one may experience a disconnectedness that makes the meaning of "distance" even more pronounced. One obstacle facing teachers is facilitating interaction, an essential component to success in traditional and distance classrooms (Fulford & Zhang, 1993b; Garrison, 1990). Traditional methods of interaction may not transfer well to television (Garrison, 1990; Moore, 1989). Having an on-site group of students may increase the comfort level, but could this greater the risk of forgetting the receive-site students? Unfortunately, if the distance learners do not perceive acceptable levels of overall interaction, they are less satisfied with the instruction (Fulford & Zhang, 1993a).

The linguistic study of discourse has a rich past (Searle, 1969; Flanders, 1970). For the distance educator, a linguistic approach may not be the most expedient. Moore (1989) says that interaction "carries so many meanings as to be almost useless unless specific sub meanings can be defined and generally agreed upon" (p. 1). He provides a framework for studying interaction in distance education suggesting three distinct, but closely related types: learner-to-instructor, learner-to-learner, and learner-to-content. The purpose of this research was to create an instrument to quantify and classify interaction in distance education using Moore's (1989) three categories. The instrument was designed to be used for instructional design consultation, distance education teacher training, and research.

Johnson (1987) found that teachers could be trained to improve their ability to facilitate interaction using video and audio tapes to analyze and categorize their behavior. He used Flanders' (1970) model of interaction analysis to develop the instrument. Flanders' system of interaction analysis was defined by Verduin (1970) as "the systematic quantification of behavioral acts or qualities of behavior [sic] acts as they occur in some sort of spontaneous interaction" (p. 32). "Teacher talk" is divided into seven sub-categories, four that are indirect, three direct. The indirect categories are: accepting feelings, praising or encouraging, accepting or using ideas of the student, and asking questions. The direct categories are: lecturing, giving directions, and criticizing or justifying authority. There are only two "student talk" sub-categories: response and initiation. "Silence" is a category falling outside the teacher and student domain. Johnson updated the names of some categories, but the meaning was essentially the same.

Changing philosophies of classroom organization are altering the way teachers facilitate interaction in the traditional classroom. Hertz-Lazarowitz and Shachar (1990) discuss the differences between the traditional "whole class" method versus a "group investigation" method. They said that "Flanders and his colleagues assessed teachers' verbal behavior mostly in traditional direct-instruction classrooms" (p. 79) and therefore, additional categories of behavior needed to be derived from observing cooperative classrooms. Altogether, twenty categories were defined from transcripts of cooperative

classes: instructing, lecture, short questions to elicit short answers, translation, interruption, disciplining one student, disciplining the whole class, disciplining by proxy, pluralizing, prompting, mediating, mechanical reinforcement, competitive reinforcement, spontaneous reference to children's initiatives, helping the child in the course of learning, encouraging interaction among children, referring matter-of-factly to problems of procedure and organization, reference to students' performance, individual personal reinforcement, and revealing emotions.

Moore (1989) has a student-centered perspective. The three types he has specified all originate from the learner, not the teacher. Johnson's (1987) and Hertz-Lazarowitz and Shachar's (1990) instruments are mainly teacher-centered. Both interaction analysis instruments to evaluate classroom dialogue are detailed and differentiate between micro-levels of teacher behavior. This suggests a major theoretical division in interaction analysis. Conventional instruments (Johnson's 1987, Hertz-Lazarowitz, & Shachar, 1990) may have been successful in traditional settings for research and training, but, applying them to the distance education TV classroom is problematic. The purpose of interaction analysis may be different. Johnson (1985) and Hertz-Lazarowitz and Shachar (1990) focus on "functional" analysis, while Moore's framework focuses on the "parties involved". Interaction analysis in the traditional classroom is often for the purpose of training new teachers (Johnson, 1987). In many distance education TV settings, veterans already have teaching skills, so the emphasis is on adjusting to the two-way capabilities of the television classroom. The dilemma is not so much compelling teachers to interact locally, but to interact with all students across the distance. Since both parties are essential to the interaction process, this research attempts to give equal care to students and teachers.

The idea of analyzing interaction in two-way television is valid, but the instrument must be suitable for the setting. Hiring trained classroom observers is costly. A workable tool has to be simple to use, and require minimal training. Videotaping may be one tool for evaluating interaction. However, videotaping alone is not enough, because no analysis can be conducted without a systematic, objective-based approach. Simply watching videos of themselves in the classroom may alienate "technophobic" teachers.

The Conceptual Framework

Some may assume that interaction requires overt speaking behavior. However, interaction has also been defined as covert behavior, that is carrying on an internal conversation (Kruh & Murphy, 1990). Therefore, it seems important to examine all facets of classroom communication in the study of interaction. Fulford (1993), in a model of cognitive speed, explains that one-way communications such as television and lectures are half the speed of the mind's cognitive capacity. The pace of one-way communication may be too slow and distract the learner. Two-way communication requires interaction, keeping the learner's mind occupied. Normal speech is usually 125-150 words per minute (wpm), but the theoretical cognitive capacity is 250-300 wpm. The model illustrates that this provides enough capacity for the speakers to simultaneously to speak and to monitor their delivery, and listeners to listen and to prepare responses. Since listening requires only 125-150 (wpm), "if they aren't engaged in a situation in which they must interact, their renegade thought patterns may dominate their cognitive activity" (Fulford & Zhang, 1993a). This may explain why anticipated interaction has been linked to positive learner attitudes (Yarkin-Levin 1983).

Flanders' (1970) direct and indirect categories also seem to reflect the idea of one-way and two-way communication. "Direct influence ... tends to minimize the freedom of the student, because the teacher directs the learning activity. The second factor, indirect influence, would have the opposite effect, or that of maximizing the freedom of the student to respond" (Verduin, p. 32).

For this study, Moore's (1989) framework of learner-to-instructor, learner-to-learner, and learner-to-content categories were sub-divided into "one-way" communication and "two-way" communication using Fulford's model (1993). Since interaction may imply a need for overt responses, the word "communication" was used to include both types of classroom behavior. One-way communication was considered a uni-directional information flow with a passive receiver. It was defined in this study as communication directed at the entire class with no expectation of a response, such as, the teacher lecturing or giving directions, a student making a presentation, or a pre-recorded video-tape being shown. Two-way communication was considered as a multi-directional information flow requiring overt interaction and active participation from at least two people. It was defined in this study as directed communication with expectation of a response. Similar to Flanders' (1970) indirect categories, this included: asking and answering questions, responding with praise, or encouraging.

In a traditional classroom, sub-categories of teacher to student and student to student may be sufficient, but in a distance setting it seemed important to analyze interaction across all sites. Although, Fulford & Zhang (1993a) indicate that every student does not have to participate publicly to enjoy satisfaction from interaction, there could be a group identity that says "if my site is not called on, I'm being ignored." For this reason, two-way communication was sub-divided into two teacher categories and five student categories. The categories differentiated between the person initializing the communication and the person responding. Teacher-to-student and student-to-teacher were standard categories. The student-to-group category was provided in consideration of collaborative learning techniques and to examine how much freedom students have to converse without teacher intervention. Teacher-to-specific location and student-to-specific location were designed to examine whether distance interaction is occurring that takes into account group identity. A student-to-all category was used to find out if students were encouraged to address everyone across the distance, rather than just the teacher. The student-to-content category was to examine how much active involvement students have with the instructional materials. Since a large part of classroom time could be taken up by management issues, non-instructional categories were provided for both one-way and two-way communications.

Flanders (1970) and Johnson (1987) both required the coding of categories every three seconds. Skill training, that lasted several hours, was supposed to acclimate the rater to three second intervals. There was no actual timing device used. Analysis was often carried out through real-time observation. In this study, video analysis had the advantage of allowing the rater to record the exact time a category occurred and to replay the instruction to be sure all coding was accurate. This method allowed coding of "events" or discrete topics instead of chopping the instruction into three second bits. Each occurrence of a category was defined as an event. An event started with the initiation of a new topic. For example, a student asked "How do you keep the mouse cage clean?" The teacher responded "Does anyone have suggestions?" Another student offered "I use soil instead of wood chips..." The teacher praises "Good idea..." When a third student asked "What do you say to the children if the mouse dies?" this begins a new topic, therefore a new event.

Analyzing interaction by category per event provides a wealth of information about the direction and participants of interaction. However, additional information can be obtained by examining single transactions. To examine the richness of an event, it is important to know how many exchanges occurred between communicators. A single exchange, although lasting several minutes is very different from numerous exchanges over the same period. Coding discrete transactions may help determine how many people were involved in the instructional event. Exchanges that involve only one teacher and one student seem limited, when the goal is to create lively group discussion. This study defined transaction as the contribution of a single individual. A series of exchanges or transactions between individuals constituted an event.

Context of the Study

The two-semester, two-credit university course used in the study provided in-service training for the Developmental Approaches in Science and Health (DASH) program. There were ten sessions from October 1991 to May 1992. DASH is a sequential kindergarten through sixth grade (K-6) program that integrates the content of science, health, and technology. The course was offered through the Hawaiian Interactive Television System (HITS) which is a 4-channel interactive inter-island closed-circuit television network that uses both Instructional Television Fixed Service (ITFS) and point-to-point microwave signals to connect six classrooms across the state. Instruction was delivered to five receive-site classrooms; there were no participants at the origination site. This was the first time this course was offered over HITS and the first time these teachers taught via two-way television.

Each session had a similar format. Participants met locally for an hour with a DASH facilitator, before the broadcast portion that lasted one hour and fifteen minutes. After a brief check-in, a pre-recorded videotape was shown for about twenty minutes. Collaborative activities took up approximately fifteen minutes, ending with each location presenting their work for three minutes. The panel answered faxed questions at the end of the session.

This course provided the occasion to examine a large number of participants over a long period of time. The researchers were not involved in the development or teaching of the course. The videos were analyzed independently by four research assistants to prevent potential bias.

Procedures and Methodology

The participants were K-6 teachers who were already using DASH in their classrooms. For most this was their first interactive TV experience. The 233 participants were in 5 locations: 98 in 2 two-way audio/one-way video locations, and 135 in 3 two-way video/two-way audio locations. The 10 sessions used in the study were recorded at the origination site. The videotapes included only the broadcast portions of the course. Due to lack of recording equipment, it was not possible to record every site at all times. Each site was shown on the screen as they participated. During discussion with one-way video sites, a still photograph of the participants was shown while the audio was heard. Collaborative activities were the greatest challenge to videotaping. The two-way video sites were scanned in sequence while open microphones collected the overall audio activity. Although this provided a sampling of what occurred during these activities, these activities were rated as a

single event and transactions were not recorded.

Four graduate students in educational technology were recruited as evaluators. All of them had completed instructional design coursework. They were given a description of the categories and then shown video-taped examples. They were shown how to code information onto the instrument. The training lasted about a half hour. The evaluators were asked not to compare their evaluation forms. They commented that the form was straightforward and easy to use. The four evaluators each analyzed the video tapes of the 10 sessions.

The Evaluation Instrument

The instrument was designed using Moore's (1989) framework for studying interaction in distance education. Three categories of interaction were examined: learner-instructor, learner-learner, and learner-content. The evaluation instrument was a half page form used to record each "event" of the lesson (see Figure 1). An "event" was defined as a single topic. For example, the teacher asked a specific question, a student answered, the teacher clarified, and another student expanded. This was one event. If the teacher asked a new question, or a student changed the focus, a new event began. The coding of the event is based on the person who initializes the topic, although other people become involved in the communication. A VCR with a time-based counter was used identify the "beginning" and "ending" time of each "event". Both were recorded on the form and a "total" time was calculated. Since ten tapes were used in the study, the tape number and event number were recorded for tracking.

The type of interaction was then recorded. "One-way" interaction was defined as communication directed at the entire class with no expectation of response. There were four "one-way" categories. "Non-instructional" events pertained to the management of the class, not the content of the lesson, these included directions about turning in homework, purchasing materials, operating equipment, and so forth. "Teacher only" events were lecture type events. "Student only" events were presentations made by students. "Content only" was for presentations using media such as pre-recorded video tapes.

Figure 1. Video evaluation instrument.

Beg. Time _____ End Time _____ Total _____ Tape/Event # _____

Type of Interaction

One-Way	Two-Way		
_____ Non-Instructional	_____ Non-Instructional	_____ Student-Teacher	
_____ Teacher Only	_____ Teacher-Student	_____ Student-Group	
_____ Student Only	_____ Teacher-Spec.Loc.	_____ Student-Spec.Loc.	
_____ Content Only	_____ Student-Content	_____ Student-All	

Transactions

_____ Total _____

_____ Total _____

_____ Total _____

UHM LCC KCC Hilo Maui Molokai Kauai Kailua # of people ___ Final _____

Notes

_____

_____

_____

"Two-way" interaction was defined a directed communication with the expectation of a response. There were eight categories of "two-way" interaction. "Non-instructional" two-way differed from "non-instructional" one-way in that responses were given. Site sign-ons are an example of a "two-way non-instructional" event. "Teacher-student" was a teacher asking a question directed to all students. "Teacher-specific location" was a teacher directing a question to a specific location or site. "Student-teacher" was the student asking a question directed to a teacher. "Student-specific location" was a student directing a question to a specific location or individual. "Student-group" was a student conversing within their own site, including the entire group or groups formed for collaborative activities. "Student-content" was a student interacting with course materials that required active participation. This category was intended for written activities, reading, or using computer assisted instruction, although in this study, none of these events occurred. "Student-all" was when a student asked a question for anyone to respond to.

Next, individual transactions were recorded. This portion of the instrument was designed to provide an indication of the richness of the communication. For example, if the teacher asked a question, a student provided a short answer, and then the teacher expounded for several minutes, the event would be very teacher focused. However, if the teacher asked a question, a student provided a short answer, then the teacher asked for elaboration, another student responded, and another teacher provided another example, the event would be richer and more student focused. These events may take the same amount of time, but by recording transactions, an instructional designer could examine patterns of interaction.

For this study, transactions were recorded by using T for teacher and S for student. If more than one teacher or student was involved in an event, numbers were added. The recording of the first example above would be T S T, the second example would be T S_2 T S_2

T_2. To insure the accuracy of the ratings, evaluators were asked to rewind the tape and record lengthy events three times (see the three lines in Figure 1). The number of transactions was counted. A final count was determined using the evaluators' best judgement which of the three attempts was most accurate. The evaluators then counted and recorded the number of people involved in each event and circled the involved sites.

Reliability

The video interaction analysis instrument was tried out during the DASH program. The raters viewed the video tapes of the ten DASH sessions independently and recorded:

1. The total number of occurrences for each type of interaction in each session.
2. The total time spent for each type of interaction in each session.
3. The total number of events in each session.
4. The total number of transactions in each session.
5. The total number of people involved in all the events in each session.

The information above was used to generate a quantitative summary of the overt interaction in the TV classroom. From Item 1, one could see how frequently each type of interaction occurred in any session and determine whether the interaction pattern over TV was balanced or appropriate. Item 2 showed the proportion of time actually spent on each type of interaction, which revealed the time reserved for the particular type of interaction. Item 3 showed how many topical segments or events of teacher-student interaction occurred (Figure 2). Item 4 showed how many exchanges or transactions occurred (Figure 3).

Figure 2

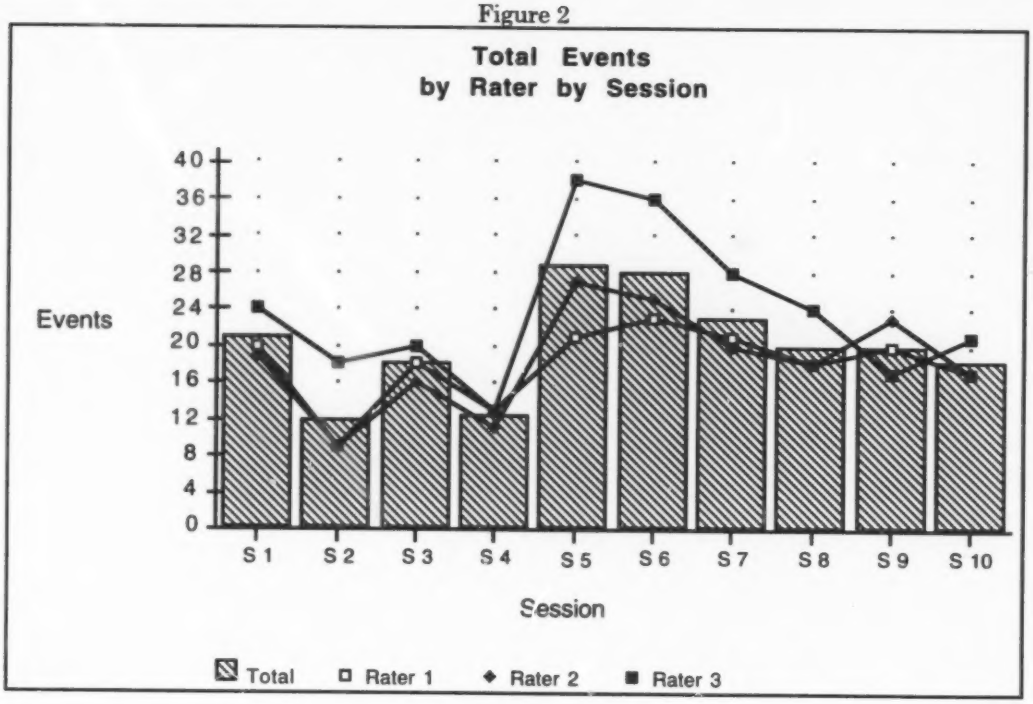


Figure 3

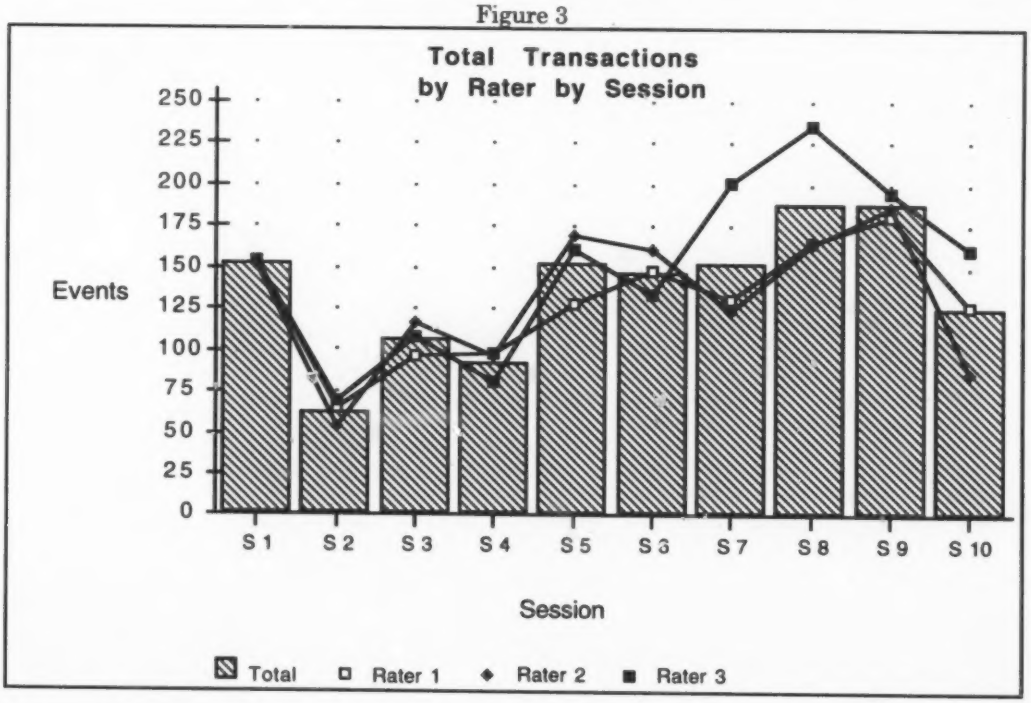


Figure 4

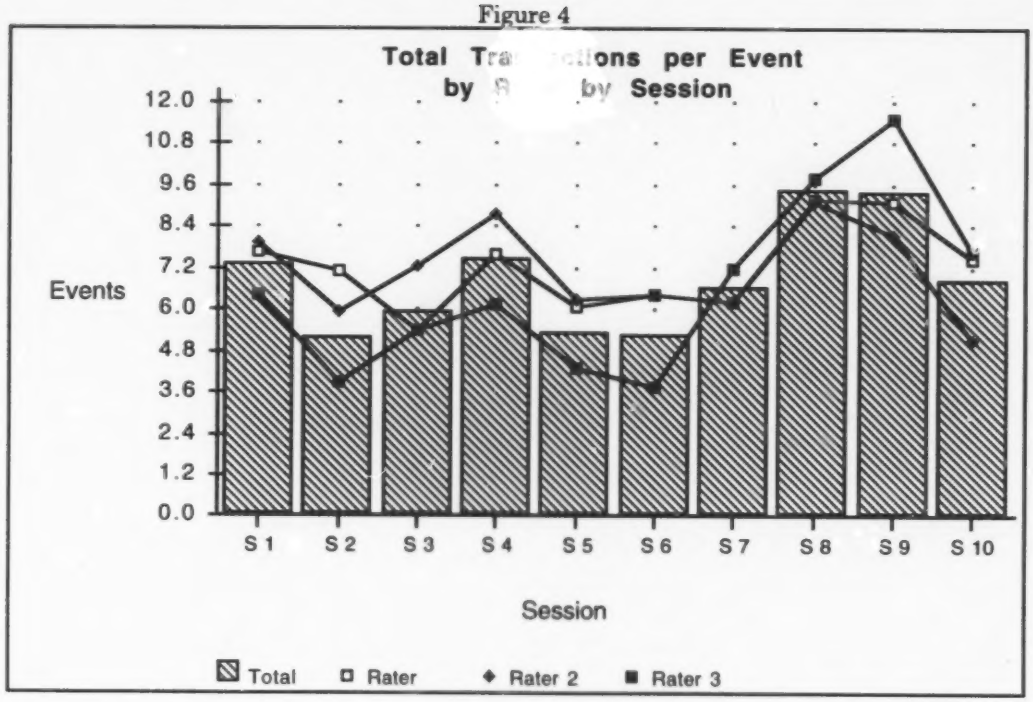


Figure 5

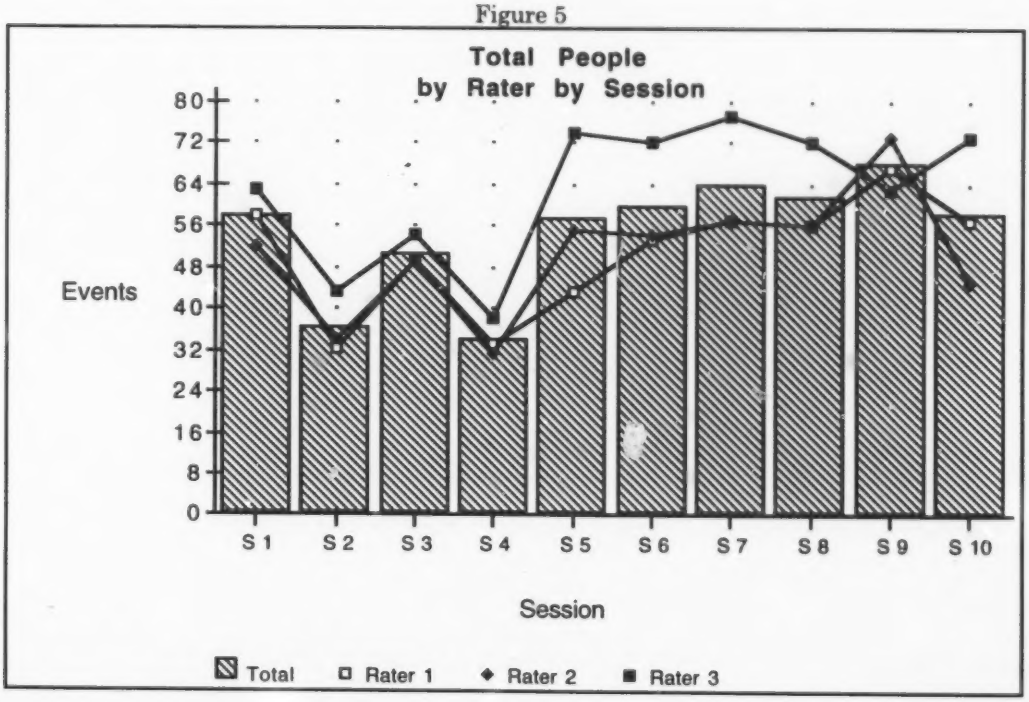
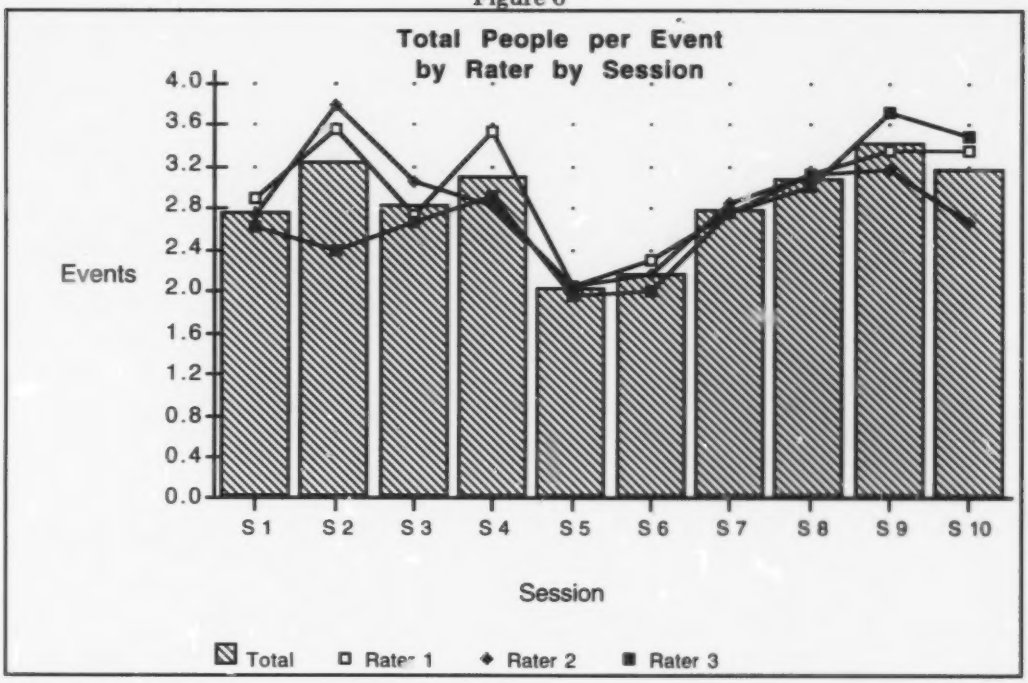


Figure 6



Items 3 and 4 produced the average number of transactions per event, which was a convenient index of the extent to which an instructor allows a topical segment to elapse (Figure 4). Item 5 showed the total involvement during the session (Figure 5). This total was derived from adding the number of people in each event, therefore, the same individuals may be counted a number of times to create this figure. Item 3 and 5, on the other hand, showed the average number of participants the instructor allowed in an event (Figure 6). A highly interactive class would be expected to generate more exchanges and engage more students per event than a lecture-type, non-interactive class.

Aggregate reliability is considered invalid if the pairwise inter-rater reliabilities vary a great deal, for instance, between - 0.6 and + 0.6 Aggregate reliability is valid only when the pairwise inter-rater reliabilities are similar (Overall, 1965). All the four raters provided the total number of occurrences for each type of interaction and the total time actually spent on each type of interaction in each session. Their mean pairwise inter-rater reliabilities and the aggregate reliabilities on the two variables are reported in Table 1. The reliabilities are generally acceptable, except in those categories where few occurrences were observed. Not all the categories of interaction are in Table 1, because some types of interaction did not take place in the DASH program. The "content only" category had only one occurrence, thereby creating a misleading perfect reliability so it was not reported.

Three raters completed analyzing the events and transactions in the video tapes of the 10 DASH sessions. Therefore, the reliabilities reported below in Table 2 were based upon three not four raters. The reliabilities reported show that using the mean of three or four raters will result in high reliabilities.

Table 1
Reliabilities for total number of occurrences and total time spent for each type of interaction

		Mean inter-rater reliability		Aggregate reliability	
Type	Sub-category	Number	Time	Number	Time
One-way	Non-instructional	0.38	0.53	0.71	0.82
	Teacher only	0.89	0.93	0.97	0.98
	One-way Total	0.60	0.85	0.86	0.96
Two-way	Non-instructional	0.72	0.62	0.91	0.88
	Teacher to student	0.39	0.33	0.72	0.68
	Student to teacher	0.81	0.66	0.94	0.89
	Student to student	0.31	0.91	0.64	0.98
	Two-way Total	0.27	0.97	0.61	0.99

Table 2
Reliabilities for total number of events, transactions, and people involved, and average number of transactions per event and people per event

	Mean Pairwise Inter-rater Reliability	Aggregate Reliability
Number of Events	0.80	0.93
Number of Transactions	0.79	0.92
Number of People Involved	0.66	0.85
Average Number of Transaction per Event	0.61	0.82
Average Number of People per Event	0.62	0.83

After the four raters had analyzed the video tapes of the 10 DASH sessions, pairwise inter-rater reliabilities and aggregate reliabilities were calculated. The pairwise inter-rater reliability is simply the correlation between the counts or recorded times of any two judges (Sax, 1989). The aggregate of effective reliability is the reliability of the mean of

the counts or times independently given by the four raters (Guilford, 1954; Rosenthal, 1987; Rosenthal & Rosnow, 1991). The aggregate reliability estimates the proportion of the variance in the mean of the four scores that is due to true scores, and its formula follows the same logic as the Spearman-Brown prophecy formula (Sax, 1989, pp. 265-266; Rosenthal & Rosnow, 1991, pp. 51-54). The aggregate reliability is higher than the mean of pairwise inter-rater reliabilities for the simple reason that employing multiple judges and adopting their mean is a more reliable scoring procedure than relying on any two potentially idiosyncratic individuals serving as raters.

Discussion

Episodes that may be categorized into more than one category were sometimes a problem. For example, the difference between "non-instructional" and "teacher to student" was not always easy to discern. An example from the tape was a conversation that began with asking about materials being mailed which is a "non-instructional" event; ended with a discussion of how the materials should be used when they arrive, a "teacher to student" event. One judge may decide to categorize the event at the beginning of the transaction, another at the end, and still another may break the event into two separate events. These episodes that do not seem to have precise beginnings and endings may cover more or less time allotment units. Such ambiguity is more evident in some categories, such as "two-way teacher-to-student" and "two-way student-to-student". It is not clear whether these categories are superfluous, or, due to the way this course was taught. Categories such as this could be grouped together, or eliminated, however, it is possible in some classes the only interaction occurring is "non-instructional." In this case, removing the category eliminates important information. The findings suggest when training judges, those categories should be emphasized.

Some sub-categories produced little or no data. For this study, "student to specific location"; "student to group"; and "student to all" were collapsed into an overall student to student sub-category to create more meaningful analysis. "Student to content" had to be eliminated for the lack of data. Does it mean these categories are superfluous? Or, is it only because of the way this particular course was taught? In the former case, they may be eliminated from the instrument or grouped in order not to distract judges. Although the rating process is simplified, removing categories reduces detailed information.

The "content" categories also caused some problems. The episode of watching a video-tape was too obvious to really test the extent of the concurrence among the raters. In the "two-way, student-to-content" sub-category, no episodes occurred. "Content" events may be both difficult to measure and difficult to include in an interactive TV setting. It may be considered a waste of costly air time to show video-tapes, have the students read, or complete written or computer assisted instruction alone. These activities can be done "off-air" while collaborative activities and a discussion of the results "on-air" may increase the amount of interaction time available. More research is needed regarding the concept of "interacting with content" as proposed by Moore (1989).

The overall reliability of this instrument is sufficiently high to warrant its use analyzing interaction in distance education. Care should be taken not to just consider the amount of time spent interacting, but also the richness and patterns of interaction. By using this instrument as a consulting tool, instructional designers may be able to help instructors improve the quality of interaction across the distance.

References

Flanders, N. A. (1970). *Analyzing Teaching Behavior*. Reading, MA: Addison-Wesley.

Fulford, C. P. (1993). Can learning be more efficient? Using compressed speech audio tapes to enhance systematically designed text. *Educational Technology, 33*(2), 51-59.

Fulford, C. P. & Zhang, S. (1993a). Perceptions of interaction: A critical predictor in distance education. *The American Journal of Distance Education 7* (3) 8-21.

Fulford, C. P. & Zhang, S. (1993b) Predicting Satisfaction with Perceptions of Interaction in Distance Learning. In G. Davies & B. Samways (Eds.), *Proceedings of the International Federation for Information Processing (IFIP)TC3 International Conference on: TeleTeaching, 93*, Trondheim, Norway: Elsevier Science Publishers B. V.

Garrison, R. D. (1990). An analysis and evaluation of audio teleconferencing to facilitate education at a distance. *The American Journal of Distance Education, (43)* 13-24.

Guilford, J. P. (1954). *Psychometric Methods* (2nd ed.). New York: McGraw-Hill.

Hertz-Lazarowitz, R. & Shachar, H. (1990). Teachers' Verbal Behavior in Cooperative and Whole-Class Instruction. In S. Hertz-Lazarowitz, R. & Shachar (Ed.), (pp. 77-94). *Cooperative Learning: Research and Theory*. New York: Praeger.

Johnson, G. R. (1987). Changing the verbal behavior of teachers. *Journal of Staff, Program and Organization Development, 5*(4), 155-157.

Kruh, J., & Murphy, K. (1990). *Interaction in teleconferencing -- The key to quality instruction.* Paper presented at the Annual Rural and Small Schools Conference, Manhattan, Kansas. ERIC Document Reproduction Service, ED 329 418.

Milheim, W. D. (1991). Implementing distance education programs: Suggestions for potential developers. *Educational Technology, 31*(4), 51-53.

Moore, M. G. (1989). Editorial: Three types of interaction. *The American Journal of Distance Education, 3*(2), 1-6.

Overall, J. E. (1965). Reliability of composite ratings. *Educational and Psychological Measurement, 25*, 1011-1022.

Rosenthal, R. (1987). *Judgment Studies: Design, Analysis, and Meta-Analysis.* Cambridge, UK: Cambridge University Press.

Rosenthal, R. & Rosnow, R. L. (1991). *Essentials of Behavioral Research: Methods and Data Analysis* (2nd ed.). New York: McGraw-Hill.

Sax, G. (1989). *Principles of Educational and Psychological Measurement and Evaluation* (3rd ed.). Belmont, CA: Wadsworth.

Searle, J. R. (1969). *Speech acts: An essay in the philosophy of language.* Cambridge: Cambridge University Press.

Shavelson, R. J. (1988). *Statistical Reasoning for the Behavioral Sciences* (2nd ed.). Boston: Allyn and Bacon.

Verduin, J. R., *Conceptual Models of Teaching* (pp. 32-43). Reading, MA: Addison-Wesley.

Yarkin-Levin, K. (1983). Anticipated interaction, attribution, and social interaction. *Social Psychology Quarterly, 46*, 302-311.

Zhang, S. & Fulford, C. P. (In Press). Interaction time and psychological interactivity: Are they the same thing in the TV classroom? *Educational Technology* .

BEST COPY AVAILABLE